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(54) Title: CONTROL STICK FOR A FINGER POINTING DEVICE

(57) Abstract: A control stick for a finger pointing device for moving a cursor on a screen of a data processing device having a keyboard, wherein the finger pointing device comprises an electromechanical transducer which is arranged beneath a key array of said keyboard and comprises an upwards facing input element which is sensitive to mechanical forces applied in lateral directions thereto. The electromechanical transducer is provided in order to convert such mechanical forces applied to its input element into electrical signals at an output thereof. The control stick may protrude above the keys of the keyboard. In one embodiment the control stick is telescopically collapsible. Other embodiments allow the protruding control stick to be detached or stowed when used with a folding portable computer, so that the control stick does not damage the display screen.

Control Stick for a finger pointing device

FIELD OF INVENTION

LEOW, Hiew Pang, Singaporean, residing at Block 496D, #07-538, Tampines Avenue 9, Singapore 520496, Republic of Singapore, solely invented a control stick for a finger pointing device. The present invention relates to a control stick for a finger pointing device for moving a cursor on a screen of a data processing device running an application, and more specifically to a control stick for a finger pointing device used in portable computers such as notebook, lap-top, palm-top computers and the like.

CROSS-REFERENCE TO RELATED APPLICATIONS

First filed in Intellectual Property Office of Singapore on 26 August 1999 allocated filing number 9904115-4.

BACKGROUND OF THE INVENTION

Known portable computers comprise generally a computer main body having a keyboard, and a cover accommodating a screen or display unit, such as a liquid crystal display device, a plasma display device or the like. The cover is coupled to the main body by hinges for allowing the cover with the display unit arranged therein to be pivoted between a closed position, in which the cover is folded down to the main body of the computer for purposes of storing and transporting the computer when not in use, and an open or folded-up position for viewing the display unit while the computer is operated. In such portable computers different types of built-in computer cursor pointing devices (mice), like touch pads, built-in trackballs or finger pointing devices are utilized. Since the mouse must be accommodated in the remaining space between the main body and the cover of the computer when the cover is in its closed position, i.e. folded down to the main body of the computer, the dimensions, and especially the height

of such a built-in mouse are severely limited.

Known finger pointing devices comprise an electromechanical transducer arranged in the main body of the portable computer underneath the keyboard thereof, and a pin-shaped actuating element as an input element of the transducer. The pin-shaped actuating element extends up from the transducer up to a level between the keys of the computer's keyboard in an orientation perpendicular to the plane of this keyboard and comprises a removable cap placed of the free top of the pin-shaped element. The pin-shaped actuating element protrudes between keys of the keyboard such that the upper surface of the cap lies approximately in the plane defined by the upper surface of the keys of the keyboard. In such a finger pointing device the electromechanical transducer converts the mechanical forces applied in lateral direction to the pin-shaped actuating element thereof into electrical signals which are then processed by the computer in order to move the cursor on the screen of the display unit.

Such a finger pointing device is operated by the user's finger by placing the finger on the top surface of the cap - which is the only surface of the cap which can be touched by the finger - and applying a pressure thereon in a lateral direction, i.e. in a direction parallel to the plane of the keyboard in order to move the cursor on the screen in a corresponding direction.

Since the contactable upper surface area of cap is very small, the cap can hardly provide a good, and especially nonskid, contact for the user's finger and requires for the operation of the finger pointing device a fairly high pressure to be applied on the cap by a single finger of the user. Furthermore, due to the small size of this pin-shaped actuating element of the finger pointing device and the high operating pressure required for application of force to the cap, the overall sensitivity of this known finger pointing device is low and, therefore, it is very difficult to achieve a fast, but accurate adjustment of the cursor on the screen. In summary, a finger pointing device of this known type is difficult and inconvenient to operate and frequent operation thereof with the same finger of the user may

even lead to inflammation of that finger.

BRIEF SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a control stick for a finger pointing device of the described type which, while being easy to operate, obviates the need for the application of high pressure by a single finger of the user during operation.

It is yet another object of the present invention to provide a control stick for a finger pointing device which can be actuated with high sensitivity and accuracy so as to achieve a fast and accurate adjustment of the cursor on the screen of the display unit. The control stick according to the invention should enable the cursor to be quickly moved from one position on the screen to another, but slowed down while approaching the desired position such that the cursor can be accurately stopped at a desired position on the screen.

These objects are achieved according to the invention by a control stick for a finger pointing device for moving a cursor on a screen of a data processing device having a keyboard, wherein the finger pointing device comprises an electromechanical transducer which is arranged beneath a key array of said keyboard and comprises an upwards-facing input element which is sensitive to mechanical forces applied in lateral directions thereto. The electromechanical transducer is provided in order to convert such mechanical forces applied to its input element into electrical signals at an output thereof. The control stick according to the invention comprises a mounting portion at its one end by which the control stick is to be mounted to the input element of the electromechanical transducer such that the mounting portion transmits lateral actuation of the control stick generated by a user to the input element of the electromechanical transducer as said mechanical forces applied thereto, and an actuating stem portion for actuating the control stick by the user. The actuating stem portion adjoins said mounting portion and has a length sufficient to protrude upright from

the keyboard substantially above the plane of the keyboard defined by its key array when said control stick is mounted with its mounting portion to the input element of the electromechanical transducer and is in an upright operational position.

The control stick according to the invention can be utilized for any type of data processing devices, like portable (foldable) computers and desktop computers. In portable computers, such as notebook computers, the electromechanical transducer of the finger pointing device, on which the control stick according to the invention is mounted, is arranged in the main body of the computer underneath the key array of the computer. In desktop computers the electromechanical transducer of the finger pointing device can be arranged in the casing of the keyboard underneath the keys thereof.

According to the invention, when the control stick is in its operational position, i.e. attached with its mounting portion to the input element of the transducer and is readily useable, it extends from the input element of the electromechanical transducer of the finger pointing device in an upright orientation relative to the plane of the keyboard and up between the keys of the keyboard, in general in the middle of the keyboard, e.g. between the letters "G", "H" and "B", substantially above the surface plane of the keyboard defined by its key array. The stem protruding or extending substantially above the surface plane of the keyboard means that the control stick according to the invention protrudes with its actuating stem portion above said plane at least by a length which allows the control stick not only to be touched on the top surface of its actuating stem portion with a single finger of the user as in case of known finger pointing devices described above, but also to be grasped comfortably, i.e. for example by two fingers (thumb and index finger) of the user, on the lateral surface of its actuating stem portion.

This enables an easy and comfortable operation of the control stick, allowing it to be operated without the need for the application of a considerably

high pressure thereto by a user's finger.

Furthermore, based on the transmission effect of a long control stick extending far above the keyboard plane of the computer, a small lateral movement of the control stick at its mounting portion attached to the electromechanical transducer, for which the latter is sensitive, corresponds to a large lateral movement of the top end of the actuating stem portion of the control stick. Accordingly, such a long control stick provides for a large operational (travel) range of the top end of the actuating stem portion of control stick in lateral directions. This also contributes to a very sensitive and accurate actuation of the input element of the electromechanical transducer by the control stick according to the invention, resulting in the possibility of a fast, very accurate and highly sensitive adjustment of the cursor on the screen of the data processing device.

According to an embodiment of the invention, the control stick is designed as a single piece straight stick, wherein the actuating stem portion thereof represents an extension of its mounting portion. In this embodiment of the invention the control stick has a fixed length. In this case the length of the section of the control stick protruding in its upright operational position above the surface plane of the keyboard is at least 0.5 cm and further preferably at least 1 cm.

According to the invention it is, however, preferred that the actuating stem portion of the control stick is adjustable in length.

According to a preferred embodiment of the invention, this can be achieved by forming the actuating stem portion of the control stick from tubes being telescopically slideable into each other.

This suggestion according to the invention enables a movement of the cursor on the screen with adjustable sensitivity, since with increasing length of the actuating stem portion of the control stick the input of the electromechanical transducer and, accordingly, the cursor on the screen can be adjusted (moved)

with higher sensitivity, and vice versa.

In the above described embodiments of the invention, if the control stick is provided for use in a foldable portable computer like a notebook computer, the mounting portion of the control stick is designed to be removably attached to the input element of the electromechanical transducer of the finger pointing device by form or force fitting. Consequently, the control stick according to this embodiment of the invention can be detached from the input element of the electromechanical transducer before closing or folding down the cover to the main body of the computer in order to prevent the display unit located in the cover of the computer from hitting against the control stick protruding above the keyboard. Such hitting could otherwise damage the display unit, and prevent the cover from being closed when the computer is not in use. Accordingly, in these embodiments of the invention the control stick is attached by its mounting portion to the input element of the electromechanical transducer only when the computer is in operation, i.e. when the cover of the computer is open.

According to a preferred embodiment of the invention the actuating stem portion of the control stick is telescopically collapsible from its upright operational position, in which it protrudes substantially above the plane of the keyboard, onto or into the mounting portion of the control stick into an upright non-operational position thereof, in which the actuating stem portion does not, or at least does not substantially, protrude above the plane of the keyboard. In this embodiment of the invention the control stick may remain attached to the finger pointing device, since the actuating stem portion can be lowered down to the plane of the keyboard or even below this plane (i.e. in the so-called non-operational position) allowing the cover of the computer to be closed without danger of the control stick harming the display unit.

According to an alternative embodiment of the invention the mounting portion and the actuating stem portion of the control stick are formed as distinct parts which are detachably connected to each other along a common longitudinal

axis e.g. by a threaded connection. In this case, the mounting portion of the control stick can be attached permanently to the input element of the electromechanical transducer of the finger pointing device and the actuating stem portion of the control stick can be detached from the mounting portion of the control stick every time the cover of the computer is to be closed, i.e. folded to the computer main body.

According to a preferred version of this alternative embodiment of the invention the mounting portion and the actuating stem portion of the control stick are connected to each other by a joint for pivoting the actuating stem portion between the upright operational position thereof and a non-operational position thereof in which the actuating stem portion extends parallel to the plane of the keyboard and is arranged between keys of the keyboard, wherein the control stick comprises a locking mechanism for locking the actuating stem portion in its upright operational position. In this case, when the control stick is attached with its mounting portion to the input element of the electromechanical transducer, the actuating stem portion of the control stick may remain attached to the mounting portion thereof even if the computer cover is to be closed, since the actuating stem portion does not protrude above the surface plane of the keyboard in its non-operational position and, therefore, does not present an obstacle to closing the computer cover to the computer main body.

In a further preferred embodiment of the invention the mounting portion of the control stick or at least a section thereof is made of a resilient material, preferably in form of a helical spring, and is attached to the actuating stem portion. According to this embodiment of the invention, the force applied to the actuating stem portion of the control stick is transmitted by the resilient section of the mounting portion to the input element of the electromechanical transducer of the
finger pointing device, thereby enhancing the dynamic sensitivity of the control stick according to the invention.

According to another embodiment of the invention it is also possible to form the control stick from a single piece helical spring, the lower part of which represents the mounting portion of the control stick and is designed so as to be attached to the input element of the transducer, e.g. by elastic clamping force.

The control stick according to the invention can be utilized as an accessory, i.e. as an attachment for the pin-shaped actuating element of the known finger pointing device discussed above. In this case, the mounting portion of the control stick according to the invention is designed to be mounted on the existing pin of the known finger pointing devices after removal of the cap attached thereto. In particular, the mounting portion comprises in this case a hole extending from its bottom surface upwards in longitudinal direction of the mounting portion and adapted with respect to its length and cross section to the length and the cross section of the pin, respectively, such as to tightly accommodate the same. The control stick of the invention can then be attached with its mounting portion to the pin of the finger pointing device by sliding the control stick on said pin, thereby achieving a tight engagement between the pin of the finger pointing device and the mounting portion of the control stick.

However, the control stick according to the invention can also be utilized as a replacement of the capped pin-shaped actuating element of a finger pointing device. In this case, the mounting portion of the control stick has to be designed so as to be adapted to the form or shape of the input element of the electromechanical transducer of the finger pointing device so that the control stick can be firmly attached with its mounting portion to the input element of the transducer.

The control stick according to the invention may further comprise a control button attached to the end of the actuating stem portion of the control stick opposite to the mounting portion of the control stick in order to further facilitate the handling of the control stick according to the invention. Preferably, the control button has a large horizontal surface area such that a finger of the user can be

comfortably placed thereon.

The objectives, features and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1A shows a notebook computer with a finger pointing device and a control stick attached to the finger pointing device according to an embodiment of the invention;

FIG. 1B shows portion 1 of FIG. 1A in an enlarged scale;

FIGs. 2A and 2B show another preferred embodiment of the control stick according to the invention, in which the control stick is formed as a telescopic stick in an extended and a collapsed operational position of the control stick, respectively;

FIGs. 3A, 3B and 3C show a modification of the control stick according to the FIGs. 2A and 2B, wherein FIG. 3A shows the control stick in an extended operational position, FIG. 3B shows the control stick in a collapsed non-operational position and FIG. 3C shows a part of the control stick according to portion II of FIG. 3A in cross-section and in an enlarged scale;

FIG. 4 shows another embodiment of the control stick according to the invention, wherein the mounting portion and the actuating stem portion thereof are detachably connected to each other;

FIGs. 5A and 5B show yet another preferred embodiment of the control stick according to the invention, wherein the mounting portion and the actuating

stem portion thereof are connected to each other by means of a joint; and

FIG. 6 shows another embodiment of the control stick according to the invention, wherein the mounting portion of the control stick comprises a helical spring.

DETAILED DESCRIPTION OF THE INVENTION

Referring initially to FIG. 1A, a notebook computer 1 is shown comprising a main body 2 and a cover 3 which accommodates a display unit or screen 5 therein and is pivotally supported on the main body 2 by hinges 4 so as to allow the cover 3 to be opened or folded-up, as shown in FIG. 1, when the computer 1 is operated, and to be closed or folded-down to the main body 2 when the computer 1 is not operated.

The main body 2 comprises a keyboard 6 on its upper portion having an array of keys 7 protruding in upright direction from the main body 2 of the computer 1.

The computer 1 further comprises a finger pointing device having an electromechanical transducer 8 arranged beneath the key array 7 in the main body 2 of the notebook computer 1.

In the following described FIGs. 1B to 6 the keys 7 of the keyboard 6 are shown in spaced apart relationship; however, this is for illustration purposes only. It should be understood that the keys 7 are usually arranged in the keyboard 6 close to each other as shown in FIG. 1A.

As shown in FIG. 1B, the electromechanical transducer 8 of the finger pointing device comprises a pin 9 forming the input element of the transducer 8 and is arranged in the main body 2 of the computer 1 such that said pin 9 extends upwards from the electromechanical transducer 8 , i.e. about parallel to the

moving direction of the keys 7, up to between the keys 7a, 7b and 7c of the keyboard 6. The electromechanical transducer 8 senses, for example by means of a pressure sensor (not shown), the mechanical forces applied to the pin 9 in lateral directions, i.e. in directions running parallel to the surface plane of the keyboard 6, and converts the sensed mechanical forces into electrical signals which are output at the transducer's output. These electrical signals are then processed by the computer 1 and cause a cursor to be moved on the screen 5 of the computer 1, while an application is run by the computer 1.

Referring to FIGs. 1A and 1B, there is further shown a control stick 10 according to an embodiment of the invention for actuating the pin 9 forming the input element of the electromechanical transducer 8 of the finger pointing device. The control stick 10 is formed as a one-piece straight stick and comprises a mounting portion 10a forming a lower section of the control stick 10, an actuating stem portion 10b forming an upper section of the control stick 10 as an extension of the mounting section 10a, and a control button 10c attached to the top end of the actuating stem portion 10b opposite to the mounting portion 10a of the control stick 10. The mounting portion 10a of the control stick is provided with a mounting hole 11 which extends from the bottom surface thereof in a longitudinal direction into the control stick 10 and has a cross section and a length adapted to the corresponding cross section and length of the pin 9 of the electromechanical transducer 8 so that the control stick 10 can be firmly, but removably attached to the pin 9 of the electromechanical transducer by pushing the control stick 10 onto the pin 9, thereby accommodating the pin 9 in the hole 11 of the control stick 10. The length of the mounting portion 10b of the control stick 10 is dimensioned such that the control stick 10, when mounted in this way on the pin 9 of the electromechanical transducer 8, protrudes upright from the keyboard 6 substantially, e.g. 1 to 5 cm, above the plane of the keyboard 6 as defined by its key array 7.

The control stem 10 allows a movement of the cursor on the display unit 5 of the computer 1 with high sensitivity and, in particular, with a much higher

sensitivity than conventional finger pointing devices since, based on the transmission effect of the long control stick 10, greater lateral movement of the user s finger actuating the control stick 10 at its actuating stem portion 10b, preferably at its control button 10c, is translated to less lateral movement of the pin 9 and, therefore, of the cursor on the screen 5.

In order to avoid damaging the screen 5 with the protruding control stick 10, the control stick 10 in this embodiment of the invention must be detached from the pin 9 of the electromechanical transducer 8 by removing the control stick 10 from the pin 9 before the cover 3 is folded down to the main body 2 of the computer 1.

FIGs. 2A and 2B show another preferred embodiment of the control stick 10 formed according to the invention as a telescopically extendable stick.

As shown in FIGs. 2A and 2B, the actuating stem portion 10b of the control stick 10 according to this embodiment of the invention is adjustable in length in that it is formed of coaxially nested tubes 12 being telescopically slideable into one another. FIG. 2A shows the control stick 10 with maximal length in its fully extended state, and FIG. 2B shows the control stick 10 with minimal length in its fully collapsed state. The actuating stem portion 10b protrudes in both states of the control stick 10 substantially above the plane of the keyboard 6, with the result that the control stick 10 remains in an operational position as long as it is attached to the pin 9 of the electromechanical transducer. Therefore, the control stem 10 has to be detached from the pin 9 of the electromechanical transducer in order to allow the closing of the cover 5 of the computer 1.

These figures depict the telescopic arrangement of the tubes 12 of the actuating stem portion 10b as in a radio antenna. However, it is also possible to additionally support and guide the coaxial tubes 12 by respective bearings (not shown) arranged between each two neighboring tubes. Spherical ball bearings can be used for cylindrical tubes 12, whereas roller bearings can be used for

rectangular tubes 12. Furthermore, it is also possible according to the invention to provide an inner tube 12 on its outer lateral surface with a high slope exterior thread and the neighboring outer tube with a corresponding thread cut into its inner lateral surface, wherein the threads engage each other such that outer tube revolves relative to the inner tube when the outer and inner tubes are telescopically slide out of or into each other. This manner of connecting the two tubes provides a certain resistance against an unintentional collapse (i.e. sliding into each other) of the control stick 10 when it is in its extended state. For example, the control stick can comprise two tubes, out of which the tube being connected to the mounting portion 10a of the control stick 10 is non-revolving, while the other tube revolves on its longitudinal axis when slided out of or into the non-revolving tube. In this case, in order to facilitate handling of the control stick 10, the control button 10c should be attached to the free end of the revolving tube in a non-revolving manner.

According to this embodiment of the invention, the adjustability in the length of the control stick 10 renders it possible to adjust the sensitivity of the control stick 10 even while in actual use, i.e. while the control stick 10 and, therefore, the cursor on the screen is being moved. Increasing the length of the control stick 10 increases the sensitivity of the cursor movement on the screen 5. Since a greater lateral movement of the control stick 10 is necessary for the same travel of the cursor, such an increase in the length of control stick 10 also increases the time required to move the cursor between two points on screen 5. Further, a shorter control stick 10 can move the cursor across the screen with greater acceleration while a longer control stick 10 can cause to move the cursor across the screen with less acceleration.

In this embodiment of the invention the control stick 10 can be attached with its solid mounting portion 10a having the mounting hole 11 therein to the pin 9 of the electromechanical transducer 8 as described in the previous embodiment of the invention.

FIGs. 3A, 3B and 3C show a modification of the embodiment of the invention described in conjunction with FIGs. 2A and 2B.

According to this modification of the invention the mounting portion 10a of the control stick 10 is formed with an upwardly open annular or rectangular groove 13 (FIG. 3C) for accommodating the telescopically slideable tubes 12 of the actuating stem portion 10b with a respective circular or rectangular cross section when the actuating stem portion 10b is fully telescopically collapsed. In this embodiment of the invention the length of the mounting portion 10a, the length of the groove 13 formed therein and the length of the tubes 12 of the actuating stem portion 10b, all taken in the longitudinal direction of the control stick 10, are matched to each other and dimensioned such that the actuating stem portion 10b of the control stick 10, when fully collapsed into the mounting portion 10b, does not or at least does not substantially protrude above the plane of the keyboard 6. Such an arrangement corresponds to a so-called non-operational position (FIG. 3B). Consequently, the control stick 10 according to this embodiment of the invention can remain attached through its mounting portion 10a to the pin 9 of the electromechanical transducer 8 of the finger pointing device even when the cover 3 of the computer 1 is to be folded down to the main body 2 of the computer 1 without harming or damaging the display unit 5 accommodated in the cover 3. Therefore, the mounting portion 10a of the control stick 10 can remain permanently attached to the pin 9 of the electromechanical transducer of the finger pointing device.

FIG. 4 shows another embodiment of the control stick 10 according to the invention, wherein the mounting portion 10a and the actuating stem portion 10b of the control stick 10 are detachably connected to each other by a threaded connection. In the embodiment of the invention shown, the mounting portion 10a is provided with a threaded bolt 14 protruding in longitudinal direction from the top surface thereof, and the actuating stem portion 10b is provided with a threaded hole 15 extending in a longitudinal direction from its bottom surface into the actuating stem portion 10b, wherein the threaded bolt 14 and the threaded

hole 15 are matched to each other. Conversely, it is also possible to provide a threaded bolt on the actuating stem portion 10b and a threaded hole in the mounting portion 10a. In this embodiment the mounting portion 10a can be permanently attached to the pin 9 of the electromechanical transducer 8, while the actuating stem portion 10b must be removed from the mounting portion 10a before closing the computer cover 3.

FIGs. 5A and 5B show another preferred embodiment of the control stick 10 according to the invention, wherein the mounting portion 10a and the actuating stem portion 10b are connected to each other by a pivotable (swivelable) joint 16 (being schematically shown in FIGs. 5A and 5B), e.g. a ball joint or a horizontal roller joint (not shown). In this embodiment of the invention the actuating stem portion 10b can be pivoted between its upright operating position, in which it constitutes an extension of the mounting portion 10a and protrudes above the plane of the keyboard 6, and a non-operational position, in which the actuating stem portion 10b extends parallel to the plane of the keyboard 6 and is arranged between keys 7 of the keyboard, as shown in FIG. 5B, so that the actuating stem portion 10b does not, or at least does not substantially extend above the plane of the keyboard 6. This eliminates the need to detach the mounting portion 10a of the control stick 10 from the pin 9 or the actuating stem portion 10b from the mounting portion 10a prior to closing the cover 3 of the computer 1. In this embodiment of the invention the control stick 10 further comprises a locking mechanism, for example a locking sleeve 18 which is slideably arranged on the mounting portion 10a and the actuating stem portion 10b of the control stick 10 and is able to bridge the joint 16 when the actuating stem portion 10b is in its upright operational position, so that the joint 16 is locked in this operational position.

FIG. 6 shows yet another embodiment of the invention, wherein an end section of the mounting portion 10a located adjacent to the actuating stem portion 10b is made of a helical spring 17 fixed with its free end to the actuating stem portion 10b of the control stick 10. It is further possible to fashion the entire

mounting portion 10a of the control stick 10 out of a helical spring which, with its end portion opposite to the actuating stem portion 10b, engages the pin 9 of the electromechanical transducer 8 with elastic clamp forces (not shown).

Furthermore, it is also possible according to the invention to fashion the entire control stick out of a helical spring (not shown).

According to the invention, the control button 10c which is permanently or detachably attached to the actuating stem portion 10b of the control stick 10 can be formed e.g. as a flat button, an upright-standing complete or partial ring or an upright-standing U-shaped element of elastic material which can gently grip and support the user's finger actuating the control stick 10 (not shown).

In those embodiments of the control stick according to the invention in which the mounting portion 10a of the control stick 10 remains attached to the input element 9 of the electromechanical transducer 8 of the finger pointing device, when the cover 3 of the computer 1 is folded down to the main body 2 of the computer, the mounting portion 10a is not allowed to protrude, when mounted, above or substantially above the upper plane of the keyboard 6, since otherwise the mounting portion 10a could possibly damage the display unit 5 when the cover 3 is closed. The same applies to the control button 10c when it remains attached to the control stick 10 in an attached non-operational position while closing the computer.

It should be noted that the invention is not restricted to a control stick 10 which is adapted, with its mounting portion 10a, to engage a pin 9 as input element of the electromechanical transducer 8 of the finger pointing device, as described in conjunction with the above preferred embodiments of the invention. Rather, the mounting portion 10a of the control stick 10 can be designed to engage and be attached, permanently or detachably, to an input element of the electromechanical transducer 8 of any other type or shape by positive or non-positive connection, gluing, etc.

While the present invention has been described and illustrated in detail, it is understood that this description is by way of illustration and example only, and is not to be taken as a limitation. The spirit and scope of the present invention being limited only by the terms of the following claims.

CLAIMS

What I claim as my invention is:

1. A control stick for a finger pointing device for moving a cursor on a screen of a data processing device having a keyboard, the finger pointing device comprising an electromechanical transducer which is arranged beneath a key array of said keyboard and which comprises an upwards facing input element sensitive to mechanical forces applied thereto in lateral directions; the electromechanical transducer being provided for converting such mechanical forces applied to its input element into electrical signals at an output thereof; the control stick comprising

a mounting portion at its one end by which the control stick is to be mounted to the input element of the electromechanical transducer such that the mounting portion transmits lateral actuations of the control stick generated by a user to the input element of the electromechanical transducer as said mechanical forces applied thereto, and

an actuating stem portion for actuating the control stick by the user, the actuating stem portion adjoining said mounting portion and having a length such as to protrude in an upright direction relative to the keyboard substantially above the plane of the keyboard as defined by its key array, when said control stick is mounted with its mounting portion to the input element of the electromechanical transducer and is in an upright operational position.

2. A control stick for a finger pointer device according to claim 1, wherein the actuating stem portion is adjustable in length.

3. A control stick for a finger pointing device according to claim 2, wherein the actuating stem portion is formed of coaxiably nested tubes which are telescopically slidable into one another.

4. A control stick for a finger pointing device according to claim 3, wherein

the actuating stem portion is telescopically slideable from its upright operational position, in which it protrudes substantially above the plane of the keyboard, onto the mounting portion into an upright non-operational position thereof, in which the actuating stem does not, or at least does not substantially protrude above the plane of the keyboard.

5. A control stick according to any one of claims 1 to 4, wherein the mounting portion and the actuating stem portion of the control stick are detachably connected to each other by threaded connection.

6. A control stick according to any one of claims 1 to 3, wherein the mounting portion and the actuating stem portion of the control stick are connected to each other by a joint for pivoting the actuating stem portion between the upright operational position thereof and a non-operational position thereof in which the actuating stem portion extends parallel to the plane of the keyboard and is arranged between keys of the keyboard, the control stick comprising a locking mechanism for locking the actuating stem portion in its upright operational position.

7. A control stick according to claim 1 to 3, wherein the mounting portion is made at least partly of a resilient material and is attached to the actuation stem portion.

8. A control stick according to claim 7, wherein the mounting portion comprises a helical spring.

9. A control stick according to any one of claims 1 to 8, wherein the input element of the electromechanical transducer comprises a pin and the mounting portion of the control stick comprises a complementary hole therein for accommodating said pin, thereby enabling the mounting of the control stick to the input element of said transducer.

10. A control stick according to any one of claims 1 to 9, further comprising a control button attached to the end of the actuating stem portion opposite to the mounting portion of the control stick.

11. Portable computer comprising a control stick for a finger pointing device according to any one of claims 1 to 10.

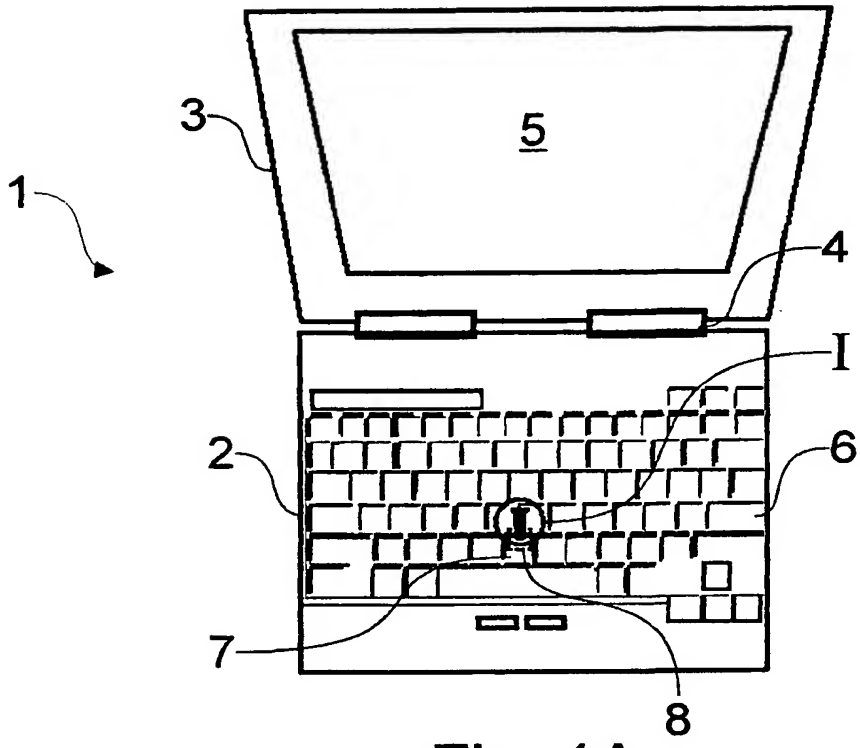

Fig. 1A

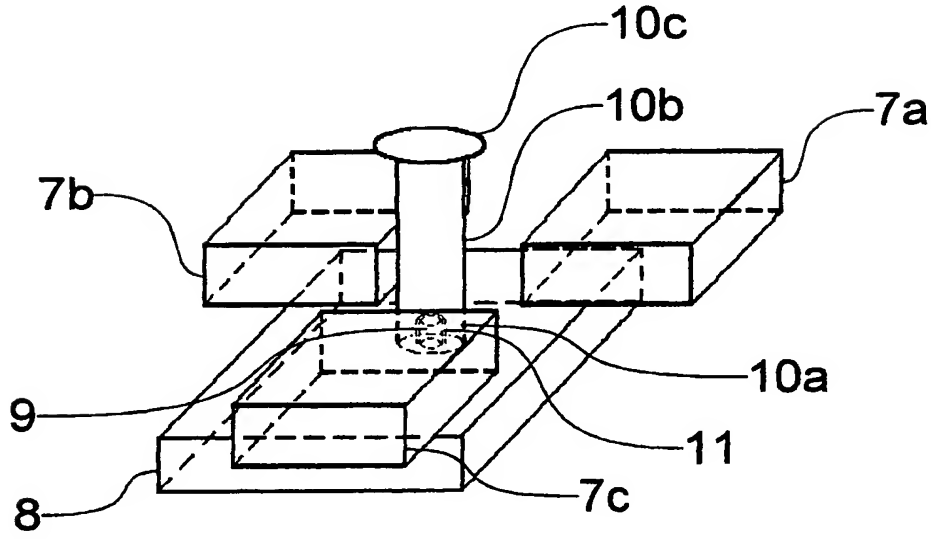

Fig. 1B

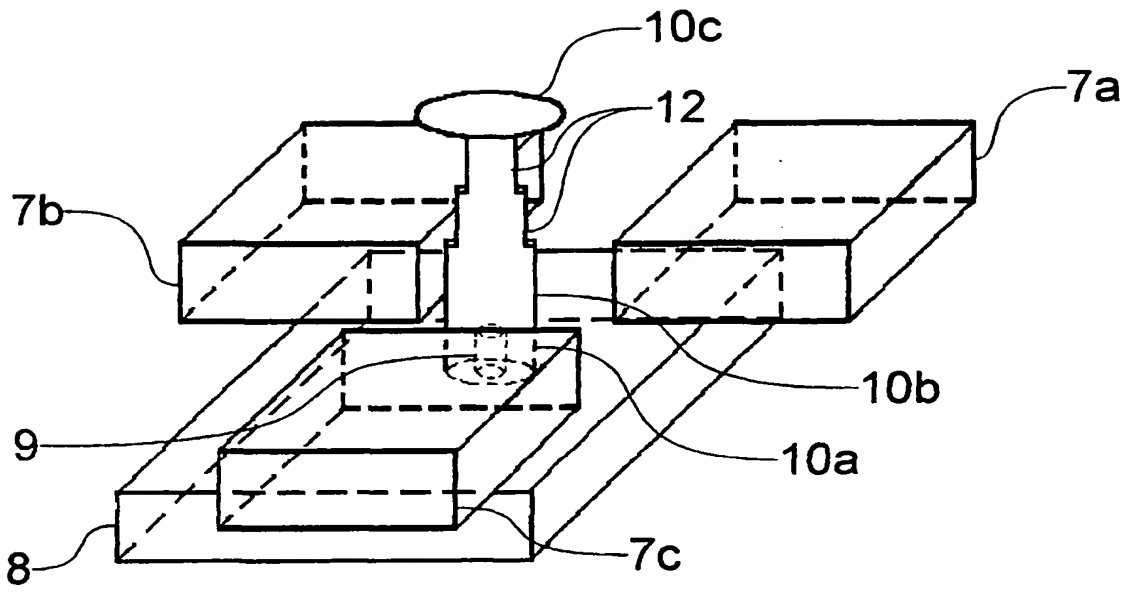

Fig. 2A

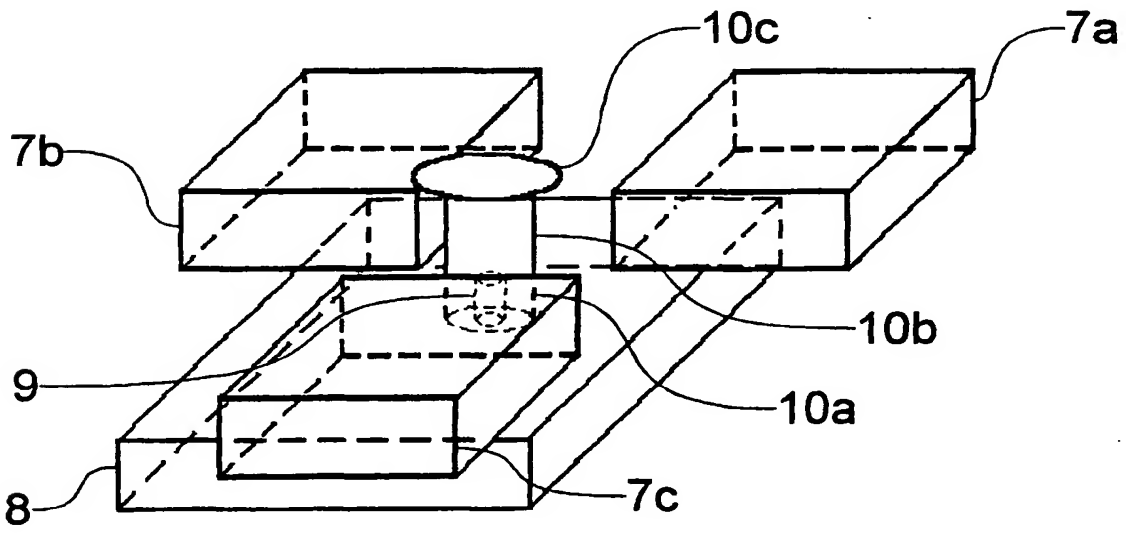

Fig. 2B

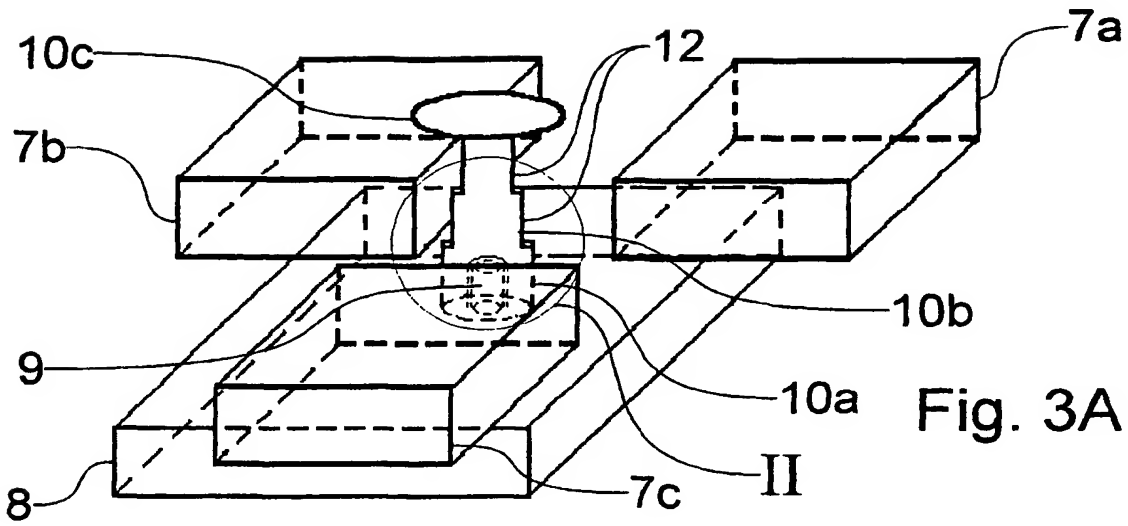

Fig. 3A

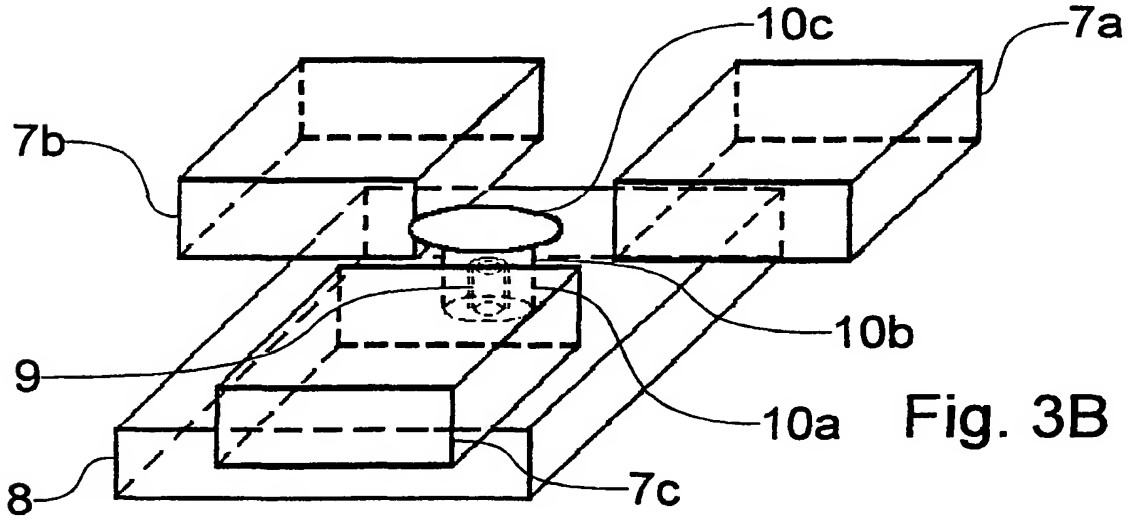

Fig. 3B

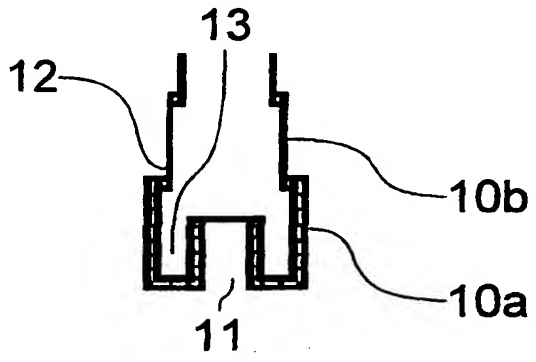

Fig. 3C

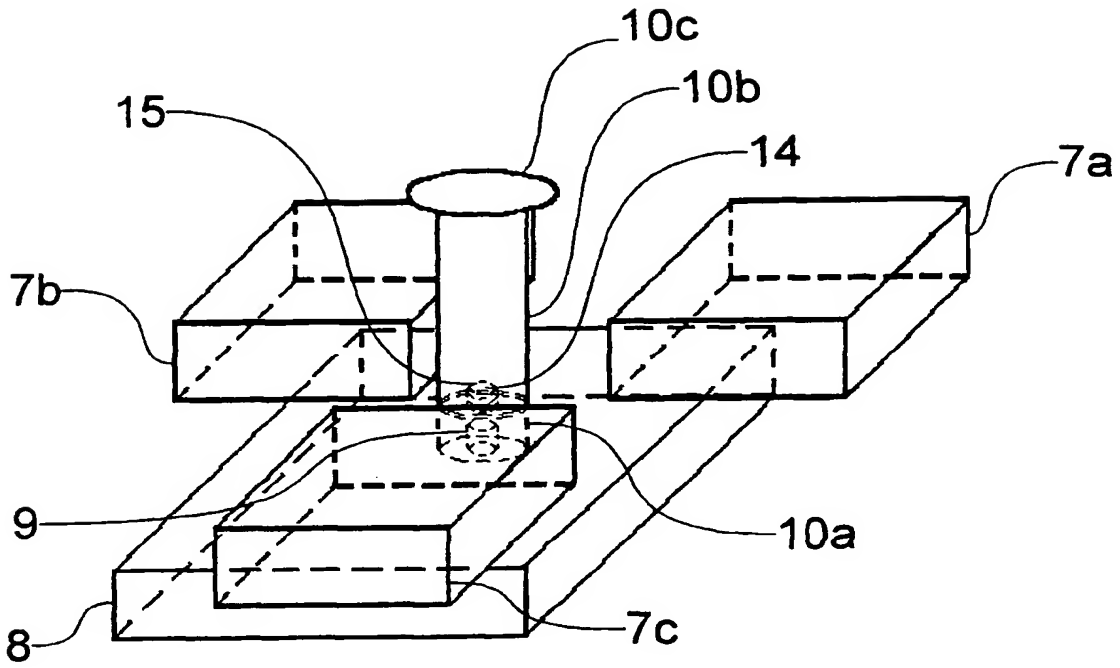

Fig. 4

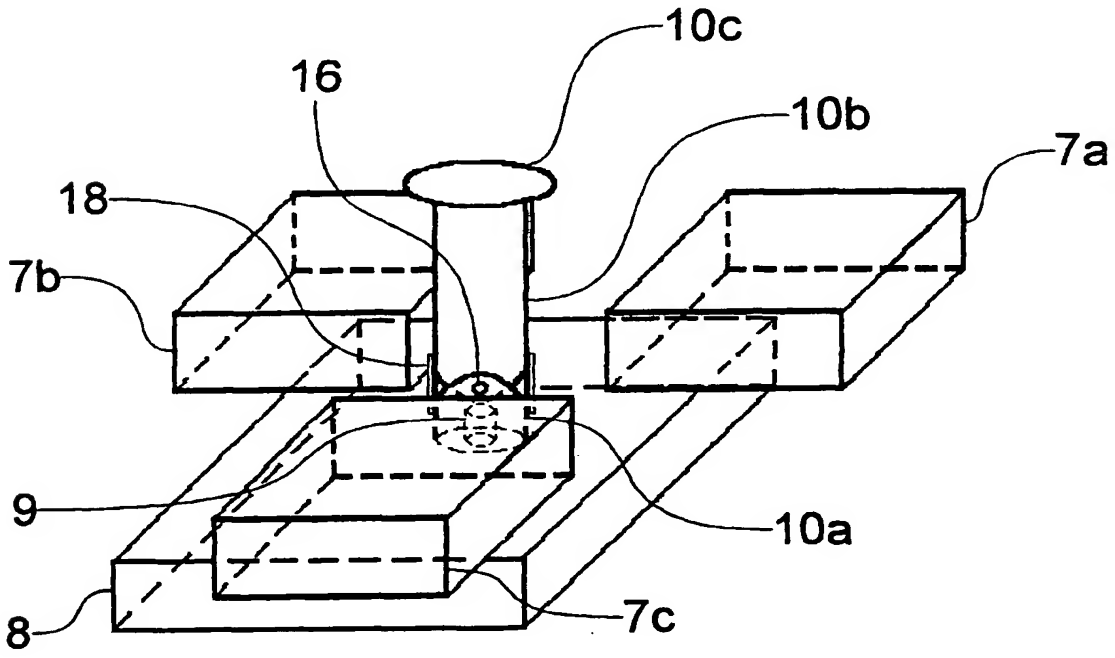

Fig. 5A

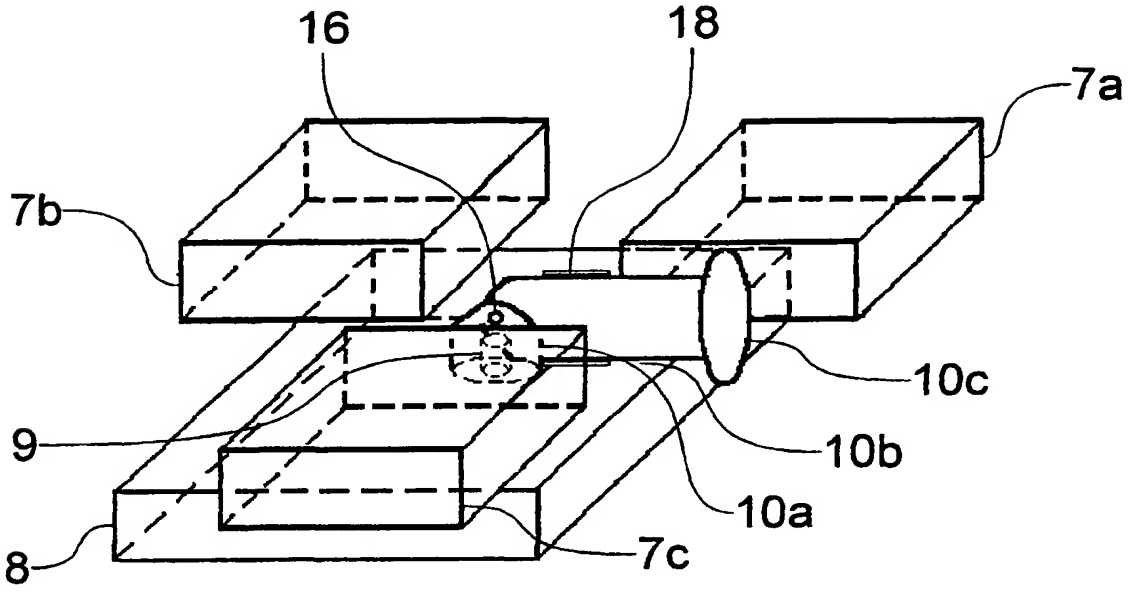

Fig. 5B

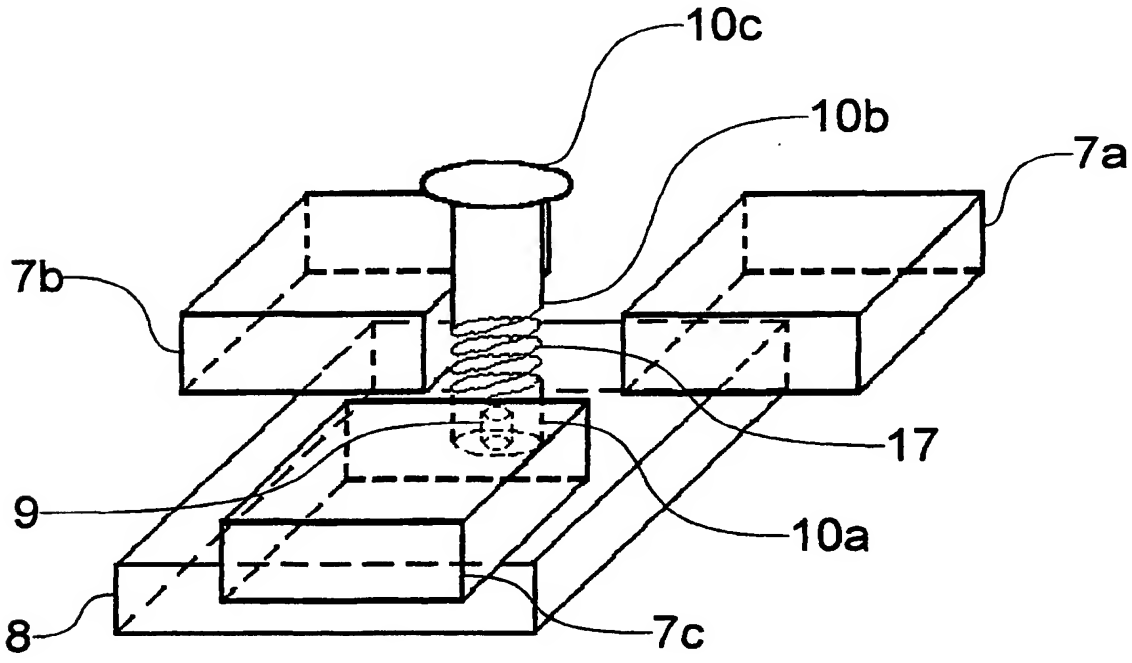

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG00/00106

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: G06F-003/033

According to International Patent Classification (IPC) or to both national classification and IPC

Minimum documentation searched (classification system followed by classification symbols)

IPC: as above

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT (stick, pointing, portable, collapsible)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 786 806 (Fester) 28 July 1998 Whole document	1,6
X Y	US 5 594 618 (Sellers) 14 January 1997 Whole document	1,10 3,4,9
X Y	US 5 407 285 (Franz) 18 April 1995 Whole document	1 3,4,9

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 November 2000	4 - DEC 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **DALE E. SIVER** Telephone No : (02) 6283 2196

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SG00/00106

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 712 660 (Martin) 27 January 1998 Abstract, figures	1,9,10
Y	EP 921 459 (CTS Corp.) 9 September 1999 Abstract,figures, claim 8	7
A	US 5 615 083 (Burnett) 25 March 1997 Abstract, figures	5
A	US 5 034 574 (Martovitz) 23 July 1991 Whole document	1
A	EP 702 288 (IBM Corp.) 20 March 1996 Abstract,figures	1

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SG00/00106

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	5786806	NO	MEMBERS				
US	5594618	EP	725329	JP	8272522		
US	5407285	DE	69122619	EP	540662	JP	5509435
		US	5231386	WO	92/02029	US	5252971
		US	6040821	US	5499041	US	5568987
		US	5701142	US	5889507	US	5339129
US	5712660	NO	MEMBERS				
EP	921459	JP	11238431	US	6040823		
US	5615083	NO	MEMBERS				
US	5034574	NO	MEMBERS				
EP	702288	BR	9503914	JP	8095691	KR	187864
		US	5694123				

END OF ANNEX